

Financing the civic energy sector: How financial institutions affect ownership models in Germany and the United Kingdom

Article (Published Version)

Hall, Stephen, Foxon, Timothy J and Bolton, Ronan (2016) Financing the civic energy sector: How financial institutions affect ownership models in Germany and the United Kingdom. *Energy Research & Social Science*, 12. pp. 5-15. ISSN 2214-6296

This version is available from Sussex Research Online: <http://sro.sussex.ac.uk/id/eprint/59254/>

This document is made available in accordance with publisher policies and may differ from the published version or from the version of record. If you wish to cite this item you are advised to consult the publisher's version. Please see the URL above for details on accessing the published version.

Copyright and reuse:

Sussex Research Online is a digital repository of the research output of the University.

Copyright and all moral rights to the version of the paper presented here belong to the individual author(s) and/or other copyright owners. To the extent reasonable and practicable, the material made available in SRO has been checked for eligibility before being made available.

Copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way.



Original research article

Financing the civic energy sector: How financial institutions affect ownership models in Germany and the United Kingdom

Stephen Hall^{a,*}, Timothy J. Foxon^b, Ronan Bolton^c^a Sustainability Research Institute, School of Earth and Environment, University of Leeds, LS2 9JT, United Kingdom^b Science Policy Research Unit, The Sussex Energy Group, Jubilee Building, University of Sussex, BN1 9RH, United Kingdom^c School of Social and Political Science, University of Edinburgh, S1 Chisholm House, High School Yards, Edinburgh EH1 1LZ, United Kingdom

ARTICLE INFO

Article history:

Received 9 June 2015

Received in revised form 2 November 2015

Accepted 17 November 2015

Available online 18 December 2015

Keywords:

Civic energy sector
Institutional economics
Energy transitions
Energy ownership

ABSTRACT

This paper examines the relations between financing institutions and more local ownership structures for energy provision. This research defines municipal and civil society structures involved in energy provision as the 'Civic Energy Sector'. It argues that the financial institutions of nations are key enabling institutions for this sector to contribute to a low carbon energy transition. The path of development of these financial institutions helps to shape the ownership structures and technology choices of energy systems and futures in different nations. This paper presents findings from case analysis comparing the United Kingdom's latent civic energy sector, with the expansion of this sector in Germany. Using an institutional economics framing, the paper demonstrates the importance of the German local banking sector in facilitating civic ownership structures in that country. In contrast, the neo-liberal, market-led financial institutions in the UK, reinforce energy pathways less reliant on civic ownership models. Hence, the forms of low carbon energy transition being pursued in these countries are constrained by path dependence of institutions both within and beyond the energy sector.

© 2015 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

1. Introduction

This paper explores the concept of a 'civic' energy sector, comprising citizen, community, co-operative and municipal ownership of energy systems. The authors argue this is a useful classification for examining the role of institutions beyond the market and state in energy transitions. The authors explore the relations between these civic ownership structures and institutions of banking and finance, arguing that the macro financial institutions of nations are key *enablers* in energy transitions. It is increasingly important to understand how financial institutions can enable civic energy participation, and how these interact with regulatory institutions, such as feed in tariff laws or portfolio standards, to constrain or incentivise different ownership forms. As such it is useful to conceive of a 'civic energy sector' as consisting of both 'community' energy schemes and municipal business models in generation, distribution, supply, and examine their enabling financial institutions.

Previous research has examined the effects of different governance and institutional framings on national energy system transitions [1,12]. However, as these system transitions are largely country-specific, this paper adopts a comparative case study of the

emerging civic energy sectors in the UK, and Germany. Understanding the enabling role of financial institutions has wider significance for assessing the potential for civic energy sectors in other nations to play a substantive role in achieving transitions to secure, affordable and low carbon energy systems.

This paper is structured as follows: Section 2 establishes the concept of a civic energy sector and highlights a gap in the literature on the role of institutions of finance in energy systems change. Section 3 describes the comparative case methodology. Section 4 presents empirical results on the participation of civic forms in the UK and Germany, and the effect of financial institutions on the deployment of renewable energies. Section 5 discusses how the contrasting emergence of a civic energy sector in these two countries has been shaped by their respective financial institutions and linked social and cultural values. Section 6 concludes the analysis and proposes further research questions.

2. The concept of a civic energy sector and the role of financial institutions

2.1. Community and municipal energy

Much work exploring civil society participation in the energy sector has focussed on community-led energy projects. These treatments often analyse the internal dynamics of organisations as

* Corresponding author.

E-mail address: stevehallrise@gmail.com (S. Hall).

opposed to taking a systemic perspective. Research has tended to focus on community generation [2–4] or investigate group formation, policy suitability and barriers to entry [5–8]. In parallel to the community energy debate, there is a growing understanding that the municipal level can be a key actor in energy transitions [9–11], particularly in a decentralised future [12,13]. However, research into municipal institutions in the energy sector has also tended towards analysis of their internal workings; or the alignment of ‘institutions, techniques and artefacts’ that bring urban actors into the energy space [14]. This is useful in understanding the institutional dynamics within the sector, but more needs to be done to understand the role of wider institutional context[s] on community and municipal ownership forms [15,16]. What has been missing is an investigation of the *enabling* institutions of civic and civil participation beyond the energy sector, and their impact on energy systems. This paper focusses on the interplay of financial institutions and civic ownership structures.

2.2. Exploring a ‘civic’ framing

To explore the effect of enabling institutions on the non-state non-corporate ownership models in the energy sector, a broad definition is needed. We adopt the term ‘civic’ because civil society and the civic sphere have often been proposed as a third element of contemporary society, beyond market and state. Civil society can provide goods and services in a way which claims to both transcend the bureaucracy and ideologies of state forms of welfare and service provision, and ameliorate the amorality of pure market approaches [17,18]. However, whereas civil society refers to a community of citizens linked by common interests and collective activity, ‘civic’ is defined as relating to a city or town, especially its administration (the municipal). Whereas civil society can be a-territorial, ‘civic’ has a particular geography and incorporates the local state or municipality. Municipalities are often classified as part of the public sector, a ‘state’ form. However the unproblematic adoption of the municipal level as a pure ‘state’ form does not capture the agency of a municipality beyond the strategies imposed upon it by higher levels of the state [38]. Whilst we do not argue for an incorporation of the municipal into civil society, we do argue that the ‘civic’ framing is a useful moniker for investigating the interplay of values, institutional form and energy system change.

2.3. Institutions as enabling agents

The financial institutions of a country are often characterised as either bank or market-based [19]. In national economies with a more [neo]-liberal political economy as in the UK, ‘market based’ finance is drawn from capital markets via equity or debt instruments traded in liquid securities. “In co-ordinated market economies such as Germany and Japan, banks play a much more important role in the long-term financing of companies as part of a broader ‘corporatist’ industrial structure” [20]. Following the Varieties of Capitalism School, this national [financial] institutional context affects the ability of economies to deploy finance to either fixed capital formation and lending to the ‘real economy’ [20]. As decentralised energy systems are a particularly visible form of fixed capital formation, one would expect institutional analysis of finance to form a greater part of energy systems research. However much energy research on financial ‘institutions’ focusses on the micro-economic institutions of market making tools and support regimes such as renewable energy subsidies [21], emissions trading mechanisms [22] and carbon pricing [23]. This has proven a rich ground of analysis for neo-classical and political/institutional economists alike. However, much less attention has been paid to how the institutional context beyond the energy sector affects how

each of these mechanisms play out (though see [24,25]) particularly at the local scale.

Sovacool [26] calls for more attention to energy institutions and the governance forms they produce. There is no uncontested definition of an ‘institution’ due to a divergence between original and neo-institutional economics [27]. We begin with Foxon’s [28] definition; institutions are ‘ways of structuring human interactions’. Here institutions are “the rules of the game”, which can include regulatory frameworks, property rights and standard modes of business organisation. Neo-institutional approaches conceive of formal and informal institutions placing constraints on human behaviour. Formal institutions are codified rules, legislation etc enforced by courts; with informal institutions comprising behavioural norms, enforced at the individual level through peer groups etc. For an example of formal institutions in the energy field see Aalto [29] who defines three types of formal institutions in energy governance (regulations and rules, actor organisations, and actor agents).

The ‘original’ institutional economics tradition views the formal/informal distinction, and its framing of institutions as pure *constraints* on human behaviour, as insufficient [30]. The original institutionalists, following Veblen [31], understand the role of institutions as *enablers* of specific action, and *shapers* of individual preference. This approach pays more attention to social rules systems, and how some institutions rely on others for legitimacy. Hall and Taylor [32] describe how the institutions of a given nation or region can lead to ‘path dependency’,—the idea that the history of institutional development through space and time matters. For an energy example, see Toke et al [62], who analyse the institutional factors beyond renewable energy price supports and geographic resource that lead to different rates of deployment of wind energy across four nations. For Provance et al. [33], renewable energy deployments are affected by socio-institutional forces such as cultural norms, values, and behaviours, which are adopted by organisations to constrain some behaviours but *enable* others. Institutions then, include the codified rules of formal institutions, informal behavioural norms *and* the layering of institutions through time which can lead to path dependency and lock in [28,34]. One must pay attention to formal institutions in structuring market interactions, *and* the social construction of institutions, historic contingency, and the complex interplay of shared values across institutional worlds. Much civil society activity relies on some form of shared norms and values, which are critical pre-conditions for community energy and institutional management of other resources [2,35,36]: “As manifestations of shared values, institutions influence agents’ preferences, choices, and actions as well as aggregate economic and environmental outcomes” ([37] p. 360).

Original institutionalism opens the study of institutions to a wider political economy. Nation states, despite ongoing processes of reorganization, have an enduring power to mould the institutional environments of given sectors [30]. This raises the question of not only *how* the state moulds institutional environments, but also *for whom*. In defining the state as strategically selective, Jessop [38] describes how in built biases of state structures make them more accessible to some groups and interests than others. Original institutional economists argue that a nation’s territorial political economy profoundly affects the spatial composition of financial institutions, which in turn affects the likelihood of these institutions to lend into local/regional organisations in the ‘real’ economy [39,40]. As Mitchell [41] and Smith demonstrate; the political economy of different nation states permeate into the institutions of energy system transitions. As such there are links between national political economy, the geography and activity of financial institu-

tions and energy systems change, which have not received enough attention from energy scholars.

2.4. The role of financial institutions in enabling energy system change

The relation of civil society institutions to renewable energy development is well reported in the Danish experience [43–45]. However these studies deal with institutional landscapes more broadly, including finance as an important agent, but not centralising financial institutions as a unit of analysis. Recent contributions have analysed the effects of territorial devolution on the institutional support for renewable energy in the UK which find the institutional landscape in the UK systemically favours major projects and large corporations [46,61], and cites a lack of compatible financial institutions in the banking sector, as a barrier to civic energy in the UK [47,59] but little work has been done to flesh out the relation to the overall institutional structure of UK banking and finance. In Germany there has been some more explicit analysis of the role of financial institutions in civic energy [48,49]. Yildiz et al. [50] highlight claims that German co-operative financing structures ‘provide the institutional framework to involve citizens with political, social, and financial aspects of renewable energy deployment’, but focus their analysis on internal dynamics of co-operatives. Whilst this work briefly acknowledges the role of local and co-operative banks in enabling the debt element of citizen finance participation, they remain unanalysed as a causal factor in growing citizen investment in renewable energies. Yildiz [49] calls for an analysis of how institutional backgrounds of these actors ‘not only give insight on how existing financial institutions and instruments complement the equity raised by citizens, but also help to develop measures and a framework to further promote investments of citizens in renewable energy’.

Two research questions follow; what role does the macro institutional context of the finance and banking sector in each nation play in *enabling* different technologies and organisational structures to proliferate? And to what degree are civic energy futures dependent on the way financial institutions respond to strategic actions of the state?

3. Methods: comparative case study of Germany and the UK

An international comparative study of the emerging civic energy sectors in Germany and the UK was undertaken. Sovacool [26] calls for comparative approaches when studying energy society interactions as they can increase the robustness and applicability of case results. Aalto [29] recognises the value of case oriented comparative method in studying energy institutions. We select the UK and Germany here, due to four elements which suggest institutional histories and path dependence will be particularly instructive. Firstly, whilst both countries are committed to low-carbon energy futures, the macro framing of these transitions differs significantly. In the UK, this is framed in terms of state creation of ‘competitive’ markets: “the Government will create markets that enable competing low carbon technologies to win the largest market share” [51]; in Germany, the ‘Energiewende’ transition is seen as involving a wide range of actors in contributing to achieving an energy systems change. Secondly, the different experiences of electricity market liberalisation. Where the UK’s market liberalisation was imposed on a nationalised and centralised electricity system, German market liberalisation took place in the context of a decentralised and municipally-led post-war reconstruction [52]. Thirdly, the historic centralisation of the UK state is in contrast to the decentralised model of the German federal system. Finally, as we study finan-

cial institutions, this comparison is important because the UK and Germany can be seen at opposite ends of a spectrum of market based (neoliberal) compared to bank based (co-ordination) economies [40]. Both systems are of a similar technical maturity, ruling out any bias based on development phases. This approach enabled investigation of the penetration of civic forms of energy provision where they could reasonably be expected to differ due in part to variations in financial institutions.

This study utilised a qualitative research design consisting of in-depth semi-structured interviews, and secondary documentary analysis of policy and statistical publications. Interviewees were selected that had interests in the finance, ownership, or governance of the energy systems in the UK and Germany, focussing on the electricity sector. Primary data is drawn from in-depth interviews with 36 individuals from across the electricity value chain in the UK and Germany. The interviewees comprised 7 utility executives (including two *stadtwerke* executives), 9 energy finance providers (from hedge funds and pensions funds to citizen and co-operative finance), 6 project developers, 5 institutional investment professionals, 2 policy professionals, 2 energy journalists, 2 energy lobbyists, 2 academics, and 1 municipal energy officer.

4. Results: civic sector involvement across the electricity value chain in the UK and Germany

Drawing on this empirical evidence base, the levels of civic sector participation in the electricity value chain are presented for the UK and Germany, and the effect of the institutions of energy policy/regulation and the structure of the financial institutions in each nation are drawn together to demonstrate how these have influenced these levels of civic sector participation.

4.1. The United Kingdom

In the UK, the starting point for a low carbon energy transition is the current liberalised energy system with highly concentrated private ownership. Prior to 1945, European electricity systems were predominantly the remit of local authorities or civic groups [53,52]. In the UK circa 300 of these organisations were involved in electricity supply [54]. Wollman et al. [52] find the post-war move to nationalised energy systems in France, Italy and the UK, a key moment in the centralisation of the energy sector. Pond describes the Conservative governments of 1979–1997 as leading an unprecedented liberalisation of the UK energy system, which benefitted from having a fully nationalised industry to privatise.

4.1.1. Generation

Following UK market liberalisation, electricity generation assets have been almost exclusively owned by corporate utilities [56–58]. In 2014, there were 32 Major Power Producers, accounting for 82.7% of installed capacity [57]. Following a series of mergers and entry of a small number of large international utilities, a ‘Big Ten’ of generation companies emerged, which includes the ‘Big Six’ vertically integrated utilities, alongside ESB, Drax, GDF Suez and AES. In 2012 these ten companies collectively owned 85.8% of UK generation assets [58]. The remaining 14.2% comprises 64 medium sized private companies and corporate entities. The ‘Big Six’ utilities own 47% of renewable capacity [57]. Whilst renewable energies have a less concentrated ownership structure than thermal generation, beneficial ownership remains predominantly in private hands (*ibid*). The community energy sector owns 0.3% of renewable capacity; approximately 60MW [59]. Comparable municipal generation statistics are unavailable but are unlikely to exceed 1% [9].

The formal institutional support system has been the Renewables Obligation which has been criticised for being too complex, characterising revenues too uncertain for civil society groups to

substantively engage with [60,61]. Other institutional barriers to civil society participation have been the planning system [18,62] and infrastructure connection problems [63]. However some of these problems can be seen as symptomatic of institutional barriers in the financial system. Many objections in the planning system have been linked to a lack of locally beneficial financial and ownership models being offered by developers [64,65]. Similarly, the complexity of the Renewables Obligation affects the ease with which commercial banks can finance the sector [66], this was reflected by one of our German interviewees:

"I have taken a look into the [UK] regulatory framework a few years ago, the certificate system [RO], and as it's totally different from the German model, [Landsbank name] decided not to work in this kind of system, because we are focusing on let's say the fixed feed-in tariffs, because it's obviously easier to do cash flow calculation based on that."

(RE Finance provider, GER, 2014)

Whilst larger schemes qualifying for the RO face financial complexity, at the sub 5 MW scale, the UK Feed in Tariffs (FiTs) and Renewable Heat Incentive (RHI) for small scale schemes are simpler, and have led to a number of innovative financing solutions that bridge the gap between institutional capital and aggregated small scale Schemes [67], some of this innovation adopts more progressive models than others:

"there's this group of people making a fortune from tax and investment vehicles, where you've got a minimum investment of 25 K and they are the ones financing the free solar type projects, they're getting the FiTs off the back of it, its money for nothing, it really is, risk free, 10–11%. That opportunity is not opened up in any way to the mass market. ... Since 2008 the richest 1% have doubled their wealth where everybody else's wealth has declined, if you see some of these investment opportunities that people with high sums to invest get access to it is insane"

(Energy finance provider, UK 2013)

The same respondent added "*what we don't have is the small medium sized capital markets*" which were seen as necessary to capitalise small to medium renewables schemes. Much of this innovative financial practise is due to a lack of compatible financial institutions in the UK at the right level to capitalise smaller FiT schemes [66].

4.1.2. Distribution

The privatisation of the UK energy system in the 1990s moved transmission and distribution networks to a regulated approach. Following mergers, the 14 regional distribution networks are now operated by seven corporate groups [68,69]. Distribution networks form natural monopolies and in the UK and Germany, operate an allowable revenues system, regulated by specific formulae [70,71]. There has been interest expressed by UK municipalities in owning distribution networks [72], but ownership of distribution assets outside private hands is still rare. There is very little opportunity for civic participation in distribution networks, largely because there is no periodic opportunity to change ownership structure.

4.1.3. Supply

In the retail market, the UK is dominated by six suppliers with 95% of domestic and 80% of commercial supply [73]. Efforts to promote more competition have led to 24 companies offering electricity and/or gas supply to households and 30 companies offering electricity and/or gas supply to commercial consumers [74,75]. Whilst the market shares of the big six are falling overall, concerns remain over the outcomes being secured by households and SMEs. There are signs of diversification, with new entrants including a

number of low-carbon energy suppliers, a co-operative supplier, and a private supplier focussed on promoting community energy. Whilst still unrealised, there is significant interest in achieving supply market penetration from civil society groups, including burgeoning interest in setting up new municipal supply companies [76]. Several formal institutional barriers to supply market penetration by civic actors have been identified [76], including barriers to supply market participation originating in a lack of financial institutions able to offer the collateral needed to enter the electricity retail market:

"the size of the money that you need to have stashed away somehow whether it's cash or collateral or parent company, guaranteed or some big brother system beside you at the table when you're negotiating these contracts gets to be a jolly big number [...] about £50m of wholesale energy. So in very crude terms if you've 100,000 customers all renewing for a year on the same day you need to find somehow £50m of collateral to secure a price quoted on day one. And that is a serious problem for any energy supplier but it's also clearly a key problem for any municipal, well any community energy group. . ."

(Utility executive, 2015)

Currently there is no 'parent company' or 'big brother system' with sufficient finance capital to support new market entrants. Larger municipal authorities may be able to source this collateral, but there are no supportive institutional structures in the financial sector to facilitate this.

4.1.4. The role of financial institutions

The UK is the archetype of market based, centralized and spatially concentrated finance [39]. Following Verdier [40], this geographic and market concentration is likely to lead to a fall in 'real economy' lending and affect fixed capital formation [77]. Whilst the UK does indeed perform poorly on both measures [20,78], these data are too broad to unpick how financial institutions capitalise energy generally, and civic energy specifically.

Blyth et al [79] show that 50% of recent UK generation fleet finance has come from debt or equity raised against the assets and cash flows of corporate utilities. Yet the ability of traditional utilities to fund requisite levels of renewables deployment is questionable [79]. This foregrounds the issue of which financial institutions the other 50% has come from, as this sector may need to expand capital allocation to energy transitions. The form of these institutions is important, because it affects the types of renewable energy preferred by investors, the energy business models they prefer to invest in, and the financial vehicles they prefer to invest with [25]; the UK respondents described the non-utility element of capacity investment:

"Pretty much all wind has been financed in two ways: half has come from the balance sheets of the utility companies and the other half has come from banks, project finance from banks"

(Institutional Investment Professional, 2013)

In the UK, relying on utility balance sheet finance and project finance from banks means relying on two centralised and internationalised sources of private capital. This has had two effects on UK energy investment. Firstly the availability of capital for the UK energy sector is more exposed to volatility in broader financial markets, as utility equity and bank debt in market based systems is closely tied to capital liquidity more generally [20]. Secondly the ability of multinational and investment capital to lend to small/medium scale projects is very low, largely due to the liquidity requirements of market based financial systems [25]. Commercial banks and utilities were very exposed to capital market volatility during the financial crisis, reducing the capital available for

energy system investment [79]. As such, recent UK energy policy (the Electricity Market Reform (EMR) package) has been designed to expand the types of financial institutions investing in renewables by attracting the ‘mainstream’ investment community [80], i.e. pension, sovereign wealth, insurance and hedge/private wealth funds:

“The main way we have to finance the transition is going to be through project finance, but the banks who currently do manage project finance aren’t going to be able to do it, so the mainstream investment community is going to be looked to”

(Institutional Investment professional, 2013 [our emphasis])

The Electricity Market Reform (EMR) package was specifically designed to attract investment from pension fund, insurance fund and sovereign wealth funds by adopting a FiT system with contracts for difference (CfDs) to secure a more stable and predictable revenue stream, thought to be attractive to these financial institutions:

“...in principle the idea, what EMR could produce is fundamentally something that could be quite attractive to the UK defined benefit pension plans if structured in the right way”

(RE Investor, 2013)

However, utility balance sheet finance, project finance from international banks, and mainstream investment finance is unlikely to capitalise myriad citizen, municipal and co-operative distributed renewable energy schemes of £20m and below:

“...there’s not many banks out there that will loan on small scale community schemes. You can only talk to the big banks if you’re borrowing millions of pounds, that’s when they’re really interested in you.”

(Co-operative energy developer UK, 2013)

In the UK it has been difficult for civil society energy schemes to source appropriate levels of finance; an issue explicitly recognised in the UK Government’s community energy strategy as a ‘finance gap’ for projects where ‘city’ level project finance does not usually start below £20m [59]. This could have been partially addressed by the UK’s Green Investment Bank, capitalised with £3.8bn public funds. But the GIB has lent £2bn to date to predominantly independent private power provision or larger public sector projects [81]. There are movements toward a smaller scale citizen finance sector in the UK. Companies such as Abundance and Pure Leapfrog are offering citizen finance debentures for small scale investors. The County of Hampshire is in the process of establishing a community bank tasked with delivering a low carbon economy, explicitly citing the German banking model as key to supporting renewable energies [82]. For now however the finance gap remains real for the smaller scale energy schemes preferred by civil society groups.

In summary, the distribution and retail elements of the UK’s electricity system incorporates little or no elements of civic ownership. Where new financial vehicles have been created by the state, they have been in the form of a CfD FiT vehicle structured for the preferences of large investment institutions, or as in the case of small scale FiTs have been beneficial to investors with significant deployable funds (see [67]). In generation, the institutional constraints of planning law, connection charges and a complex subsidy system are widely recognised. This research adds to this with an understanding that the institutions of a market based financial system find it very difficult to capitalise small scale renewables, and so civil society ownership and civic participation in energy generation is likely to remain niche without changes to the system of financial institutions.

4.2. Germany

In Germany, the ‘Energiewende’ transition begins from a more decentralised ownership base. In West Germany in particular, there was no nationalisation of the electricity system and post-war reconstruction retained existing principals of local self-government, remaining largely under municipal ownership. The ‘stadtwerke’ (municipally owned utilities) provided the majority of energy services. European market reforms struggled in the German energy sector, which remained [largely] under municipal control until European directives, specifically 96/92/EC [83], forced monopolies to break by introducing the right to switch supplier and requiring the unbundling of generation, supply and transmission [84]. This led to a wave of mergers resulting in a ‘big four’ emerging from the previous eight vertically integrated energy companies [85]. This posed a challenge to the Stadtwerke which had operated local or regional integrated monopolies; though many saw this as an opportunity to invite private capital into their shareholder structure or divest themselves of energy obligations.

Market liberalisation saw a reduction in Stadtwerke from circa 900–600 [52]. However, there has been a return to municipal and community ownership of energy infrastructures, referred to as re-communalisation [86]. This refers to the re-establishment of stadtwerke but also incorporates other civic ownership structures, such as co-operatives. The number of Stadtwerke active in energy has risen to approximately 850 [87]. By 2012, 170 communities had won back distribution grid concession contracts, 60 new stadtwerke had been formed [86] and the post-liberalisation dilution of municipal equity in stadtwerke is being reversed [52].

4.2.1. Generation

Installed capacity in 2014 was 196,133 GW and comprised 707 individual power producing companies [88]. There is a lower concentration of ownership in thermal generation with the ‘Big Four’ (E.ON, EnBW, RWE and Vattenfall) owning 33.4% of total generation capacity (ibid). Stadtwerke own 6% of total installed capacity [89], where part or all of the beneficial ownership rests with municipalities. 33% of installed capacity is made up of <10 MW installations supported by the German Feed in Tariff (EEG) with a diverse ownership structure which is expanded on below. The remaining 28% comprises hundreds of companies with individual installations, larger corporations with multiple sites and co-operative and citizen wind parks (Fig. 1).

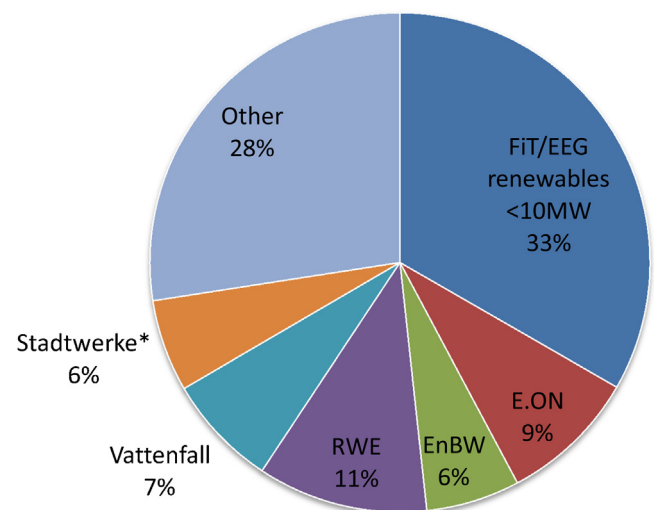


Fig. 1. German installed capacity by ownership 2014. (Source: Bundesnetzagentur, 2014 [88])

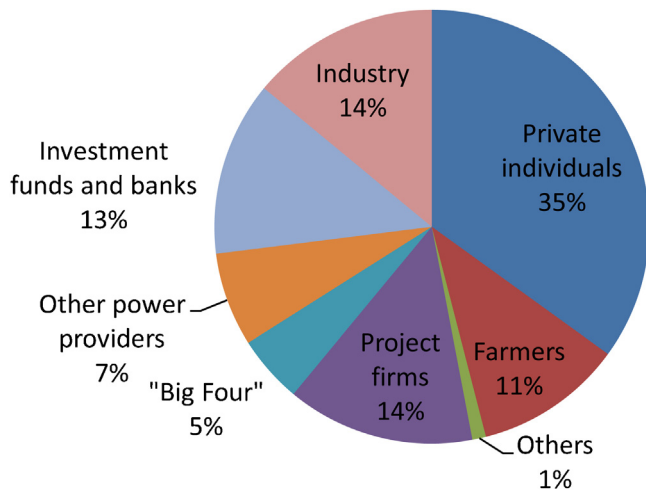


Fig. 2. Ownership of installed RE capacity in Germany (2012).
(Source: German Renewable Energies Agency, 2013 [90])

Whilst conventional generation in Germany incorporates significant elements of municipal, citizen, co-operative and community ownership, it is the ownership structures of installed renewable capacity that vary most markedly from the UK. Ownership of renewable generation assets is diverse and incorporates multiple non-corporate, non-state models (Fig. 2).

Industry, Germany's 'Big Four', project firms, other power providers and investment funds/banks account for only 53% of renewable capacity ownership. The Stadtwerke are classed as 'other power producers'. The category "Investment funds and banks" is heterogeneous and contains institutional investors such as pensions and insurance funds as in the UK, closed end funds structured by specialised issuing houses and funds drawing on high net worth Individuals. Part of this segment is within this definition of 'civic' energy via the civic institutions of finance defined in Section 4.2.4.

For the 35% of renewables under 'private individuals' this constitutes structures through which energy co-operatives, private householders and communities develop renewable generation. DGRV estimate that more than 800 new energy cooperatives have invested circa 1.3 billion euros in renewable energy projects [90]. The co-operative share has increased to constitute 21% of the 34GW installed capacity under citizen ownership [53].

An important driver of this civic ownership of renewable generation is the creation and retention of value within local economies:

"We're really democratising the energy system by allowing everyone in Germany the opportunity, or giving everyone the opportunity to participate in the system. And that's something that has put the Energiewende at the heart of political priorities."

(Energy Journalist, 2014)

"So you can feel this entrepreneurship and this regional community thing in this kind of business. It is very impressive that there is millions and millions in investments in the region from the money of the people into regional projects using regional craftsmen etc. I think this is the key story of energy co-operatives in Germany. It's more about regional development."

(Co-operative Banking Group Executive, 2014)

These notions of democratisation, local value retention and regional development as motivators for civic participation in energy transitions are present in the UK [76] but there was a substantially deeper appreciation of renewable energies as constitutive

of citizen empowerment and regional economic development amongst our German respondents.

Numerous studies highlight the role of the German feed in tariff system or EEG law as particularly supportive of civic participation in energy [91,92]. It is clear that the formal institutional structure of the EEG was a catalyst for renewables development in Germany. How this was enabled by German financial institutions is the focus of Section 4.2.4.

4.2.2. Distribution

According to the VKU (association of municipal utilities), around 60% of distribution concessions in Germany remain with stadtwerte [94]. Co-operative ownership of distribution infrastructure does exist through, though new energy co-ops are less engaged in distribution grid activity [95]. Whilst some re-communalised concessions are small, there have been large re-municipalisations. A significant example is Hamburg, where in September 2013, 50.9% voted in favour of re-municipalisation and the city has agreed purchased the grid from Vattenfall for between 495 and 550 million Euros [95]. There are several reasons cited for re-municipalisation/communalisation trend. Respondents consistently identified acceleration of renewable penetration and retention of energy value as key drivers:

"..The clear goal is to accelerate the energy transition and the ways to operate the grid in terms of supporting the change to renewable energies [...] another motivation is this empowerment idea yes, this is something I have observed in many citizen driven energy co-ops, the do it yourself philosophy. We can do it on our own."

(Source: Co-operative energy developer, 2014)

Several respondents questioned how the acceleration of grid investment to integrate renewables could be achieved through re-communalisation, given that municipal/citizen grid operators are subject to the same allowable revenues structure as private grid operators. Some recent studies show the values accruing to municipalities from grid investments include, but are not limited to: increased tax bases, employment opportunities, and energy security [97,98,72]. These studies support the case for grid infrastructure to be cross subsidised from revenues outside the regulated charge structure. Further, municipalities recognising the benefits of high-quality grid infrastructure within their own territory, are prepared to accept a lower return on the asset base, and stipulate that retained revenues be re-invested in grid services:

"The main effect [of being municipally owned] is we are not talking every quarter, every year about results and profits. The communes [municipalities] are long term oriented, because they are very much interested in a very good and safe reliant infrastructure."

(Stadtwerke executive, 2014)

The re-municipalisation of grid infrastructure is not wholly unproblematic. Capital cannot be raised through equity issue without diluting municipal control [98]. Also, where municipalities or co-operatives wish to develop generation capacity, grid infrastructure has to compete for discretionary capital expenditure [99].

In Germany there is a heterogeneous ownership structure for electricity distribution assets which is tending towards re-communalisation. Proponents believe this will accelerate the energy transition and retain values from energy infrastructures locally.

4.2.3. Supply

The German electricity supply market comprises over 1000 companies [101]. This includes approximately 850 stadtwerte that often only supply customers within their territorial footprint,

though larger stadtwerke will supply business customers beyond their territory. 60–70 Co-operative utilities were reported as active in energy supply by two interviewees, but this is unconfirmed. An average German household is able to choose between 80 electricity suppliers [101]. Estimates of municipal supply market share range between 31% [101] and 46% [102]. The domestic market share of the Big Four reported by BDEW (2012) was 43.8%, which has declined in recent years but only from a high of circa 50% [99].

A supplier landscape with a high degree of municipal involvement in the form of Stadtwerke changes the use to which profits from electricity supply are put. The VKU state that their members:

“...do not primarily pursue private commercial objectives but are guided by public welfare obligations. In our democratic system, they operate under local self-administration to serve “citizen value”, i.e. to meet the needs of the local community. The type of capital they form and secure is a community-oriented asset.”

(Resolution of the VKU Executive Committee of 26 February 2008, available at [104])

Whereas almost 100% of the dividends from UK electricity supply companies are distributed via international capital markets, the profits from stadtwerke, which comprise between a third and a half of the electricity supply market, can be used for a number of social, environmental and economic development goals which may or may not be energy related. To take an example from a large entity, Stadtwerke Köln returned circa 265 Million Euro to the city in 2011, most of which was derived from energy services [105]. Respondents identified the advantages of being a municipal utility rather than a corporate utility:

“It is the possibility to make earnings. Before, 100 years ago it was to cover the needs of inhabitants and now it's about the local economy”

(Stadtwerke executive, 2014)

“[City name] was one of the first cities in the beginning of the 90s that set up a local climate protection concept in 2006–2007 this was a programmes with measures. This was decided by the city council, in 2008 there was a climate alliance with the city and the Stadtwerke”

(Stadtwerke executive, 2014)

Yet Stadtwerke are diverse organisations. Respondents described a spectrum of those that were supportive of citizen energy to those which were ambivalent or hostile due to the effect of citizen energy on their business models. These results do not describe municipal energy companies as universally positive, unproblematic entities, nor is municipal ownership a pre-determinant of energy transition. It was however clear that their ability to appropriate value from energy supply, means that, depending on the decisions of municipal actors, a proportion of energy value can be locally retained and recycled into decarbonisation and energy transition, the fiscal stability of the local state, and/or cross subsidise other local services.

4.2.4. The role of financial institutions

The expansion of citizen, municipal and co-operative stakes in the German energy sector has been enabled by financial institutions that incorporate three traits unfamiliar in the UK's centralised sector: local subsidiarity, common public benefit values and promotional lending. There is an established local banking sector in Germany, in which the scales of loans are more compatible with distributed energy schemes. The two main institutions in this sector are the Savings Banks Group (Sparkassen and Landesbank) and the co-operative banks (Volks and Raiffeisen Banks). The sav-

ings banks and co-operative banks are not small players—in 2014, they comprised 62% of all small business loans, almost 100% of loans to tradespeople, 50% of consumer credit, 42% of loans to municipalities and 60% of mortgages [106]. However, each regional bank is a separate business under the institutional form of a savings/mutual bank. Where the UK has 162 banks, Germany has over 1600 [107]; though much like the stadtwerke, not all customers can access all savings/co-operative banks, as they are territorially bound:

“The difference between a savings bank and other lenders is that the savings bank will not withdraw [...] it is anchored within that local area and also bound to only operate in that local area, will have to live off the profits that it can make in that local area. [...] So each and every savings bank can adapt its actual business to the condition it finds in the local area; and that is very important. That is this decentralised model.”

(Savings Bank Executive, 2014)

“...the local co-operative banks, they are rooted or backed in the regions [...] In Germany we have a little bit less than 1100 Volksbank and Raiffeisen banks [...] we don't want to have such big units that we are not near enough to the customers and therefore we are still quite a lot of Volksbank and Raiffeisenbank so that they are anchored in the regions on a local level.”

(Co-operative Bank Group Employee, 2014)

This decentralised model has been proposed as an additional financial institution for the UK, which would better support household and SME lending [108]. The territoriality principal and proximity to customers and business was cited several times by interviewees as an *enabler*, building local knowledge and capacity for small scale renewables investment. The following shows the much wider participation a savings bank can have in driving the decentralised energy economy:

“... Sparkasse Heidelberg has started ten years ago when they first issues a loan for renewable energy in households and today they have a very large market share in that in their area but also a very high number of installations operating solar energy. And they had to invest of course, they had to invest in skills, in technicalities, they set up a centre of competence and now it works and this is profitable both for the people who took the loans and also for the savings bank”

Savings Bank Group Employee, 2014 [emphasis added]

Whilst there is no special relationship to stadtwerke, as the majority lender to German public authorities, the savings bank group is closely invested in municipal as well as citizen energy schemes (see [109] p. 30–31; and [110]). For the co-operative banks, the natural channel for energy related investment is through both direct investment and debt provision to support the equity stakes of circa 800 energy co-operatives:

“So there's a close relation between the co-operative banks and energy co-operatives on the regional or local level. So a lot of new renewable energy co-operatives were founded or were supported by co-operative banks. So they supported business plans so they built the right stuff”

(Co-operative Bank Group Employee, [emphasis added] 2014)

Both the savings and co-operative bank groups are key institutional promoters and supporters of civil ownership of energy assets, and they are not passive institutions. They provide developmental support to civic energy expansion as well as capital. The aims and objectives of this local banking sector are compatible with the notions of subsidiarity/self-government, economic stability, environmental protection and social welfare expressed by actors across

the value chain in Germany's civic energy sector. Because of this, both of the local banking institutions of Germany actively promote local ownership and control of the energy sector:

“politically we have a very clear opinion about what we call re-communalisation. So also in Germany not all the energy suppliers are in municipal hands, there is a strong tendency to switch that and we support that switch. How do we do that? First of all we are advocating all kinds of decentralised energy supply [...] this is really something where civil society, where communities where municipalities where people from outside the authorities get together and try to create something and try to be independent and take some responsibility for their lives and that is something that is very close to the founding mission of the savings banks. ...”

(Savings Bank Group Employee, 2014)

Energy co-operatives are local companies, they pay tax to local authorities. That's different to a national or international project developer who runs a wind farm here in Brandenburg close to villages and nobody is involved. So the benefits of these projects remain in the region and that is very important. That's why a lot of co-operatives banks support the foundation of these energy co-operatives.”

(Co-operative Banking Group Employee, 2014)

A key enabler of the growth of this local energy finance is the existence of refinancing loans from the German public development bank KfW. KfW utilises its strong credit rating to source capital market finance and offers refinancing options for renewable energy and energy efficiency loans. Between 2009 and 2013 the savings banks and co-operative banking group accounted for circa 74% of the €16.2bn distributed through KfW promotional energy lending (Interviewee, 2014) a great majority of this finance is for loans under €25m [111]. This is clearly having substantive systemic effects, as can be seen by the more than 33% of German electrical capacity being accounted for by <10 MW capacity (Fig. 1). Between customer deposits and KfW finance, a strong institutional framework for risk shared investment in civic energy is maintained.

In Germany, a dense network of locally rooted banking institutions is able to offer strategic support and renewable energy loans on favourable terms to small, medium and (utilising regional partners) sometimes large renewable energy schemes. They do so because renewable energy in Germany is seen as a sound investment that is compatible with their respective founding principles, investment priorities and governing values.

5. The civic energy sector and enabling institutions

Whilst there have been several investigations into specific elements of the community, municipal, co-operative, and citizen financed energy sectors in both the UK and Germany, this research provides a novel investigation of the effects of national financial institutions on the proliferation of civic energy. The findings discussed above demonstrate the importance of understanding how financial institutions enable civic energy participation, alongside examining how regulatory institutions such as feed in tariff laws and portfolio standards constrain or enable particular actors and ownership forms.

In the UK case, the three main support mechanisms for renewable energy have been capitalised by financial forms created by the incumbent, market based institutional system. The complexity of the Renewables Obligation makes participation from non-specialist market entrants difficult, both for civic actors and financial institutions more used to working with fixed FiT structures. The move to FiT auctions under EMR was an explicit move to bring in large main-

stream investment capital. One might argue this demonstrated a strategic selectivity by the state (Jessop [38]) that openly favoured existing financial interests. However, it may be more accurate to characterise this as a reaction to institutional path dependence rather than the interests of capital, in that devoid of bank and utility capitalisation of renewables, and in a market based financial system, the only viable alternative in the short term was to seek capital from actors on financial markets. Whilst this further structurally disadvantages civic energy actors, it is more to do with institutional path dependence in the financial system, than an outright result of financial sector lobbying or incumbent influence. In parallel, even the small scale FiT, which is more closely related to the German EEG law [66], and should be more amenable to civic participation, has largely been captured by financial institutions beyond civil society. The ‘finance gap’ identified in the UK remains real, due to a set of institutional conditions that are outside the traditional purview of energy policy. This landscape of market based financial institutions is structurally unsuited to allocating capital to small scale renewables. As such it is difficult to see where expanded civic participation is going to come from without extending the reach of energy and other infrastructural policy into the UK institutions of finance.

What is important in the German case is the integration between the bank based financial institutions of the German economy and the civic energy sector. Statutes on public benefit lending enshrined in savings bank governance and strong shared value frameworks in the co-operative banking sector meant the EEG law was introduced into a fertile environment for civic energy participation. This research identified a commitment to regional economic stability and self-governance as important shared values across the civic energy sector.

The German state's decision to allow KfW promotional lending to act as capital refinancing through the institutions of savings and co-operative banks is a different example of state selectivity of financial institutions in the energy space. This meant that a dense network of smaller scale institutions allocate capital to small and medium scale energy schemes through an established framework of citizen investment and mutual ownership models. In contrast, the UK's green investment bank, the only analogous financial institution, has lent almost exclusively to utility scale generation through corporate actors. Whilst this research has characterised the UK's civic energy sector as niche, there is evidence of a revitalisation of civic energy participation led by UK municipal authorities [112,113]. This is important because the growth of institutions with compatible values can manifestly be mutually supportive, and bring new business models and institutional forms into the energy sector.

6. Conclusions

This paper has investigated the impact of civil society institutions on the energy sector in the UK and Germany, and their potential role in the energy system transitions underway in these countries. Both energy systems co-evolved with the institutions of finance capital active in their respective nations. Where the UK was found to have a latent but growing civic energy sector, Germany shows a strong sector with established institutional links based on shared value frameworks. The civic energy sector in Germany incorporates municipal institutions, co-operatives, and citizen investment and re-communalisation groups. These actors are not always harmonious, yet they do form a substantive part of the energy system that are subject to different dynamics than state or corporate institutions.

Clearly these are broad characterisations and mask some important conflicts and nuances within a complex environment both

in Germany and the UK. Civic actors and compatible financial institutions exist in the UK (though in specific niches) and commercial bank lending and insurance fund participation are established features of the German renewables market. Equally, whilst the involvement of private equity in stadtwerke has fluctuated, municipals and Lander often have significant holdings in private utilities. However, this research has clearly identified the importance of the macro-economic context of financial institutions for the emergence of local energy ownership structures, with financial institutions as active *enablers* in energy transitions, which shape the ownership structures and technology choices of the energy transitions of different nations.

This research has implications for the realisation of a low carbon energy transition in these and other countries. The UK and Germany lie towards opposite ends of the spectrum of liberalised market to co-ordination economies, and their market-based vs bank-based financial institutions reflect this. The forms of low carbon transition currently being pursued reflect this institutional path dependence, with the UK government framing the transition in terms of state creation of 'competitive markets', compared to a more inclusive 'Energiewende' in Germany. This suggests that, if the UK and other market based economies want to encourage the development of a civic energy sector, they would need to do more to develop appropriate financial institutions, such as more locally oriented banks, to support this. This is important in terms of realising the potential of the civic energy sector to contribute to a transition in these countries, and also in terms of the extent to which benefits from these investments are able to be retained within these localities.

There is a clear need for further analysis of financial institutions as important enablers in energy transitions. Further research would benefit from focussed quantitative analysis of the volumes and types of lending to civic energy groups. Further analysis of how market based vs bank based economies capitalise energy transitions would shed light on the links between energy policies and national varieties of capitalism. Finally, an investigation of the final costs different financial institutional landscapes impose on energy transitions would demonstrate which forms of sector capitalisation can achieve energy transitions both within credible cost frameworks and with the requisite public support.

Acknowledgements

This paper builds on research carried out under the 'Realising Transition Pathways: Whole Systems Analysis for a UK More Electric Low Carbon Energy Future' Consortium Project funded by the UK Engineering and Physical Sciences Research Council (EPSRC) [under Grant EP/K005316/1]. However, the views expressed here are those of the authors alone, and do not necessarily reflect the views of the collaborators or the policies of the funding body. The authors would also like to thank the reviewers for their close engagement, as we felt their feedback helped us to improve the paper.

References

- [1] T.J. Foxon, Transition pathways for a UK low carbon electricity future, *Energy Policy* 52 (2013) 10–24.
- [2] S. Wirth, Communities matter: institutional preconditions for community renewable energy, *Energy Policy* 70 (2014) 236–246.
- [3] G. Walker, P. Devine-Wright, Community renewable energy: what should it mean? *Energy Policy* 36 (2008) 497–500.
- [4] C. Nolden, Governing community energy—Feed-in tariffs and the development of community wind energy schemes in the United Kingdom and Germany, *Energy Policy* 63 (2013) 543–552.
- [5] G. Seyfang, J.J. Park, A. Smith, 'A thousand flowers blooming? An examination of community energy in the UK and flowers blooming? An examination of community energy in the UK', *Energy Policy* 61 (2013) 977–989.
- [6] A. Schreuer, D. Weismeier-Sammer, Energy cooperatives and local ownership in the field of renewable energy technologies: a literature review, in: RiCC—Research Report. Research Institute for Co-operation and Co-operatives (RiCC), Vienna University of Economics and Business, Vienna, 2010, pp. 1–46.
- [7] F.P. Boon, C. Dieperink, Local civil society based renewable energy organisations in the Netherlands: exploring the factors that stimulate their emergence and development, *Energy Policy* 69 (2014) 297–307.
- [8] S.M. Hoffman, A. High-Pippert, From private lives to collective action: recruitment and participation incentives for a community energy program, *Energy Policy* 38 (12) (2010) 7567–7574.
- [9] M.J. Hannon, T.J. Foxon, W.F. Gale, The co-evolutionary relationship between Energy Service Companies and the UK energy system: implications for a low-carbon transition, *Energy Policy* 61 (2013) 1031–1045.
- [10] Schöberger, P., 2013. Municipalities as key actors of German renewable energy governance: an analysis of opportunities, obstacles, and multi-level influences (No. 186). Wuppertal Papers.
- [11] J. Rutherford, S. Jaglin, Introduction to the Urban energy governance: local actions, capacities and politics, *Energy Policy* 78 (2015) 173–178.
- [12] Realising Transition Pathways Engine Room, 2015. Distributing power: a transition to a civic energy future. Realising Transition Pathways Research Consortium. Available at: <http://www.realisingtransitionpathways.org.uk/publications/FINAL.distributing-power-report.WEB.pdf>.
- [13] T. Blanchet, Struggle over energy transition in Berlin: how do grassroots initiatives affect local energy policy-making? *Energy Policy* 78 (2015) 254–256.
- [14] H. Bulkeley, V.C. Broto, A. Maassen, Low-carbon transitions and the reconfiguration of urban infrastructure, *Urban Stud.* 51 (7) (2014) 1471–1486.
- [15] T. Moss, Socio-technical change and the politics of urban infrastructure: managing energy in Berlin between dictatorship and democracy, *Urban Stud.* 51 (7) (2014) 1432–1448.
- [16] J. Rutherford, O. Coutard, Urban energy transitions: places, processes and politics of socio-technical change, *Urban Stud.* 51 (7) (2014) 1353–1377.
- [17] Pestoff, V., 1998. Beyond the market and state: social enterprises and civil democracy in a welfare society.
- [18] G. Walker, P. Devine-Wright, Community renewable energy: what should it mean? *Energy policy* 36 (2) (2008) 497–500.
- [19] T. Beck, R. Levine, Industry growth and capital allocation: does having a market-or bank-based system matter? *J. Financial Econ.* 64 (2) (2002) 147–180.
- [20] C.J. Berry Ryan-Collins, T. Greenham, Financial System Resilience Index Building a Strong Financial System, New Economics Foundation, London, 2015.
- [21] L. Butler, K. Neuhoof, Comparison of feed-in tariff, quota and auction mechanisms to support wind power development, *Renew. Energy* 33 (8) (2008) 1854–1867.
- [22] M. Grubb, K. Neuhoof, Allocation and competitiveness in the EU emissions trading scheme: policy overview, *Climate Policy* 6 (1) (2006) 7–30.
- [23] J.E. Aldy, R.N. Stavins, The promise and problems of pricing carbon: theory and experience, *J. Environ. Dev.* (2012), <http://dx.doi.org/10.1177/1070496512442508>.
- [24] T.J. Foxon, P.J.G. Pearson, Towards improved policy processes for promoting innovation in renewable electricity technologies in the UK, *Energy Policy* 35 (2007) 1539–1550.
- [25] S. Hall, T.J. Foxon, R. Bolton, Investing in low carbon transitions: energy finance as an adaptive market, *Climate Policy* (2015), <http://dx.doi.org/10.1080/14693062.2015.1094731>.
- [26] B.K. Sovacool, What are we doing here? Analyzing fifteen years of energy scholarship and proposing a social science research agenda, *Energy Res. Soc. Sci.* 1 (2014) 1–29.
- [27] G.M. Hodgson, *Economics in the Shadows of Darwin and Marx*, Edward Elgar Publishing, 2006.
- [28] T.J. Foxon, A coevolutionary framework for analysing a transition to a sustainable low carbon economy, *Ecol. Econ.* 70 (12) (2011) 2258–2267.
- [29] P. Aalto, Institutions in European and Asian energy markets: a methodological overview, *Energy Policy* 74 (2014) 4–15.
- [30] D. MacKinnon, A. Cumbers, A. Pike, K. Birch, R. McMaster, Evolution in economic geography: institutions, political economy, and adaptation, *Econ. Geogr.* 85 (2) (2009) 129–150.
- [31] T.B. Veblen, Why is economics not an evolutionary science? *Q. J. Econ.* 12 (1898) 373–397.
- [32] P.A. Hall, R.C. Taylor, Political science and the three new institutionalisms*, *Polit. Stud.* 44 (5) (1996) 936–957.
- [33] M. Provance, R.G. Donnelly, E.G. Carayannis, Institutional influences on business model choice by new ventures in the microgenerated energy industry, *Energy Policy* 39 (9) (2011) 5630–5637.
- [34] G.C. Unruh, Understanding carbon lock-in, *Energy Policy* 28 (12) (2000) 817–830.
- [35] C.C. Gibson, T. Koontz, When community is not enough: institutions and values in community-based forest management in southern Indiana, *Hum. Ecol.* 26 (4) (1998) 621–647.
- [36] E. Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action*, Cambridge University Press, Cambridge, 1990.
- [37] J. Paavola, W.N. Adger, Institutional ecological economics, *Ecol. Econ.* 53 (3) (2005) 353–368.

- [38] B. Jessop, State theory: Putting the Capitalist State in its Place, Penn State Press, 1990.
- [39] D. Wójcik, D. MacDonald-Korth, The British and the German financial sectors in the wake of the crisis: size, structure and spatial concentration, *J. Econ. Geogr.* (2015) bu056.
- [40] D. Verdier, *Moving Money: Banking and Finance in the Industrialized World*, Cambridge University Press, Cambridge, 2002.
- [41] C. Mitchell, *The Political Economy of Sustainable Energy*, Palgrave Macmillan, Basingstoke, 2008.
- [42] J. Simmie, Path dependence and new technological path creation in the Danish wind power industry, *Eur. Plan. Stud.* 20 (5) (2012) 753–772.
- [43] P. Karnøe, Technological innovation and industrial organization in the Danish wind industry*, *Entrepr. Reg. Dev.* 2 (2) (1990) 105–124.
- [44] J. Szarka, Wind power, discourse coalitions and climate change: breaking the stalemate? *Eur. Environ.* 14 (6) (2004) 317–330.
- [45] S. Dawley, Creating new paths? Offshore wind, policy activism, and peripheral region development, *Econ. Geogr.* 90 (1) (2014) 91–112.
- [46] J. Harnmeijer, M. Parsons, C. Julian, The community renewables economy starting up, scaling up and spinning out, in: *Respublica Green Paper*, Respublica, London, 2013.
- [47] M. Bolinger, Community Wind Power Ownership Schemes in Europe and Their Relevance to the United States, Lawrence Berkeley National Laboratory, 2001.
- [48] Ö. Yildiz, Financing renewable energy infrastructures via financial citizen participation—the case of Germany, *Renew. Energy* 68 (2014) 677–685.
- [49] Ö. Yildiz, J. Rommel, S. Debor, L. Holstenkamp, F. Mey, J.R. Müller, J. Rognli, Renewable energy cooperatives as gatekeepers or facilitators? Recent developments in Germany and a multidisciplinary research agenda, *Energy Res. Soc. Sci.* 6 (2015) 59–73.
- [50] HM Government, The carbon plan, in: *Delivering our Low Carbon Future*, HMSO, London, 2011.
- [51] H. Wollmann, H. Baldersheim, G. Citroni, G. Marcou, J. McEldowney, From public service to commodity, in: *The Demunicipalization (or Remunicipalization?) of Energy Provision in Germany, Italy, France, the UK and Norway. The Provision of Public Services in Europe, Between State, Local Government and Market*, Northampton, Cheltenham, 2010, pp. 168–190.
- [52] C. Julian, *Creating Local Energy Economies Lessons from Germany*, Respublica, London, 2014.
- [53] Y.J. Rydin, C. Turcu, S. Guy, P. Austin, Mapping the co-evolution of urban energy systems: pathways of change, *Environ. Plan. A Int. J. Urban Reg. Res.* 45 (3) (2013) 634–649.
- [54] Bloomberg New Energy Finance, Big Six Investment Trends: A Report for Greenpeace UK on the Investment Trends of the Big Six Utilities, BNEF, 2012.
- [55] Dukes, 2014. Electricity: Chapter 5, Digest of United Kingdom energy statistics (DUKES), Department of Energy and Climate Change. August 2014, available at: <https://www.gov.uk/government/statistics/electricity-chapter-5-digest-of-united-kingdom-energy-statistics-dukes>.
- [56] I. Rutledge, Who Owns the UK Electricity Generating Industry and Does it Matter, SERIS, Chesterfield, 2012.
- [57] Decc, Community Energy Strategy: Full Report, Department for Energy and Climate Change, London, 2014.
- [58] J. Szarka, Wind power, policy learning and paradigm change, *Energy Policy* 34 (17) (2006) 3041–3048.
- [59] P.A. Strachan, R. Cowell, G. Ellis, F. Sherry-Brennan, D. Toke, Promoting community renewable energy in a corporate energy world, *Sustain. Dev.* 23 (2) (2015) 96–109.
- [60] D. Toke, S. Breukers, M. Wolsink, Wind power deployment outcomes: how can we account for the differences? *Renew. Sustain. Energy Rev.* 12 (4) (2008) 1129–1147.
- [61] D.J. Swider, L. Beurskens, S. Davidson, J. Twidell, J. Pyrko, W. Prügler, R. Skema, Conditions and costs for renewables electricity grid connection: examples in Europe, *Renew. Energy* 33 (8) (2008) 1832–1842.
- [62] C.R. Warren, M. McFadyen, Does community ownership affect public attitudes to wind energy? A case study from south-west Scotland, *Land Use Policy* 27 (2) (2010) 204–213.
- [63] P. Devine-Wright, Local aspects of UK renewable energy development: exploring public beliefs and policy implications, *Local Environ.* 10 (1) (2005) 57–69.
- [64] M. Mendonça, The UK Feed-in Tariff: A User Survey, Working Paper, Birkbeck College, University of London, 2011.
- [65] R.W. Saunders, R.J.K. Gross, J. Wade, Can premium tariffs for micro-generation and small scale renewable heat help the fuel poor, and if so, how? Case studies of innovative finance for community energy schemes in the UK, *Energy Policy* 42 (2012) 78–88.
- [66] Ofgem, (2014) The GB electricity distribution network. Accessed online July 2014 at: <https://www.ofgem.gov.uk/electricity/distribution-networks/gb-electricity-distribution-network>.
- [67] A. Cumbers, M. Danson, G. Whittam, G. Morgan, G. Callagan, Repossessing the Future: A Common Weal Strategy for Community and Democratic Ownership of Scotland's Energy Resources, The Jimmy Reid Foundation, Biggar, South Lanarkshire, 2013.
- [68] Müller C., Advancing regulation with respect to dynamic efficient network investments: insights from the United Kingdom and Italy, in: *Competition and Regulation in Network Industries*, vol. 13, No. 3, 2012, pp. 256–272.
- [69] D. Xenias, C.J. Axon, L. Whitmarsh, P.M. Connor, N. Balta-Ozkan, A. Spence, UK smart grid development: an expert assessment of the benefits, pitfalls and functions, *Renew. Energy* 81 (2015) 89–102.
- [70] S. Hall, T.J. Foxon, Values in the smart grid: the co-evolving political economy of smart distribution, *Energy Policy* 74 (2014) 600–609.
- [71] Ofgem, State of the Market Assessment, Office of Gas and Electricity Markets, London, 2014.
- [72] A. Moss, R. Buckley, Competition in British Business Energy Supply Markets: An Independent Assessment for Energy UK, Cornwall Energy, Norwich, 2014.
- [73] R. Buckley, A. Moss, Competition in British Household Energy Supply Markets: An Independent Assessment, Cornwall Energy, Norwich, 2014.
- [74] Hall, S., Roelich, K.E., 2015. Local Electricity Supply: Opportunities, archetypes and outcomes. Ibuild/RTP Independent Report. March 2015, Available online at: https://research.ncl.ac.uk/ibuild/outputs/local-electricity_supply_report.WEB.pdf.
- [75] R.M. Stulz, Financial structure, corporate finance and economic growth, *Int. Rev. Finance* 1 (1) (2000) 11–38.
- [76] World Bank IDRB IDA, 2015. Gross Fixed Capital Formation as% of GDP, World Bank national accounts data, and OECD National Accounts data files. Available at: <http://data.worldbank.org/indicator/NE.GDI.FTOT.ZS>.
- [77] Blyth, W., McCarthy, R., Gross R., 2014. Financing the Power Sector: is the money available. United Kingdom Energy Research Centre Working Paper. Available online at www.ukerc.ac.uk/support/tiki-download_file.php?file=3628, (accessed 05.14.).
- [78] Bloomberg New Energy Finance, How to attract new sources of capital to EU renewables, in: *Clean Energy White Paper*, Bloomberg New Energy Finance, 2013.
- [79] Green Investment Bank, 2015. Summary of Transactions to Date, Available at: <http://www.greeninvestmentbank.com/media/44778/gib-transaction-table-210515.pdf>.
- [80] Future Solent, 2014. Hampshire Community Bank <http://www.futuresolent.org.uk/our-programme/hampshire-community-bank/0>.
- [81] Directive, E.C., 2003. Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003, concerning common rules for the internal market in electricity and repealing Directive 96/92/EC. European Union, online at: <http://eurlex.europa.eu/LexUriServ/LexUriServ.do>.
- [82] Thomas, S., 2005. The European Union Gas and Electricity Directives. Available at <http://gala.gre.ac.uk/3629/>.
- [83] G. Kungl, Stewards or sticklers for change? Incumbent energy providers and the politics of the German energy transition, *Energy Res. Soc. Sci.* 8 (2015) 13–23.
- [84] Verband Kommuner Unternehmen, 2012. The re-communalisation trend: <http://www.vku.de/service-navigation/presse/pressemitteilungen/liste-pressemitteilung/gemeinsame-pressemitteilung-120926.html>.
- [85] D. Hall, Re-Municipalising Municipal Services in Europe, London, PSIRU, 2012.
- [86] Bundesnetzagentur, 2014. List of Generators. Accessed online August 2014, available at: http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Energie/UnternehmenInstitutionen/Versorgungssicherheit/Erzeugungskapazitaeten/Kraftwerksliste/Kraftwerksliste_2014.xlsx?__blob=publicationFile&v=14.
- [87] Verband Kommuner Unternehmen, 2013. Results of the 2013 Generation Survey, VKU, Berlin. Accessed online at: www.vku.de/energie/energieerzeugung/kommunale-kraftwerkskapazitaeten/aktuelle-ergebnisse-der-vku-erzeugungssabfrage-2013.html.
- [88] Renewable Energy Agency, 2013. Renewable energy in the hands of the people, accessed online July 2014 at: <http://www.unendlich-viel-energie.de/media-library/charts-and-data/renewable-energy-in-the-hands-of-the-people>.
- [89] A. Weig, A. Müller, DGRV-Jahresumfrage unter Energiegenossenschaften zeigt: Aktuelle Energiepolitik führt zu Investitionsrückgang, DGRV, Berlin, 2014.
- [90] C. Mitchell, D. Bauknecht, P.M. Connor, Effectiveness through risk reduction: a comparison of the renewable obligation in England and Wales and the feed-in system in Germany, *Energy Policy* 34 (3) (2006) 297–305.
- [91] VKU, 2014. Kommunale Ver- Und Entsorgungsunternehmen in Zahlen. Available at: http://www.vku.de/index.php?eID=tx_nawsecuredl&u=0&g=0&t=1444518779&hash=fc582139c5062ffdc7e5278a724aa0e75e565898&file=fileadmin/media/Bilder/VKU_ZahlenDatenFakten_2014.pdf.
- [92] Dgrv, Energy Cooperatives: Results of the DGRV-Survey, DGRV, Berlin, 2015.
- [93] K. Heinbach, A. Aretz, B. Hirschl, A. Pahl, S. Salecki, Renewable energies and their impact on local value added and employment, *Energy Sustain. Soc.* 4 (2014) 1.
- [94] J. Mühlenhoff, 2010. Value creation for local communities through renewable energies: results of the study by the Institute for Ecological Economy Research (IÖW), *Renews Special Issue* 46/December 2010.
- [95] D. Buchan, *The Energiewende—Germany's gamble*, Oxford Institute for Energy Studies, 2012.
- [96] Bundesnetzagentur, 2015. Annual monitoring report, Bundesnetzagentur, Berlin. Available at: http://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/BNetzA/PressSection/ReportsPublications/2014/MonitoringReport_2014.pdf?sessionid=1E68B574FBEA204328C7A7C809AA5F77__blob=publicationFile&v=2.

- [102] Apergis, A., 2014. Stadtwerke awarded a competitive advantage in the current market; Migration risks and potential new customers for regional electricity supplier: TNS, Available at: <http://www.tns-infratest.com/presse/presseinformation.asp?prID=3298>.
- [104] Vku, 2015. About us <http://www.vku.de/en/ueber-uns.html>, (accessed 05.15.).
- [105] S. Köln, The Future of the Stadtwerke in a Changing Energy Market, CIRIEC, Vienna, 2012, 12–14th September 2012.
- [106] DSGV, The Savings Banks Finance Group: An Overview, DSGV, Berlin, 2014.
- [107] Koetter, M., 2013. Market structure and competition in German banking—modules I and IV—(Frankfurt School of Finance and Management Working Paper 06/2013*) November 2013, Available at: <http://www.sachverstaendigenrat-wirtschaft.de/fileadmin/dateiablage/download/publikationen/arbeitspapier.06.2013pdf>.
- [108] Civitas, The German Sparkassen (Savings Banks): A Commentary and Case Study, Civitas, London, 2013.
- [109] Dsgv, The Savings Banks Finance Group Profile 2012, DSGV, Berlin, 2012.
- [110] Dsgv, 2015. Our responsibility—report to society. DSGV, Berlin. Available at: http://report-society.dsgv.de/EN/Energy_transition.Wind.energy.php.
- [111] KfW Bankengruppe, 2012. German approaches in promoting energy efficiency KfW best practice experience Workshop on Energy Efficiency. London, February 2012 available at <http://www.feslondon.org.uk/cms/files/fes/pdf/London.Friedrich.Ebert.pdf>.
- [112] Newcastle City Council, 2014. Budget Proposal 2014–2015: civic enterprise—maximise income through trading services. Newcastle City Council, February 2014.
- [113] Core Cities, 2013. Core cities growth prospectus policies Step 6: Power up the cities, core cities, accessed February 2nd 2014 at: <http://www.corecities.com/what-we-do/publications/core-cities-growth-prospectus-policies-step-6-power-cities>.